

Successful retrieval of a knotted Swan-Ganz catheter using interventional approach in an adult: a case report

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Sir,

Swan-Ganz catheterization, also known as the balloon tipped pulmonary artery catheterization, is widely used as a diagnostic and hemodynamic tool to monitor patients in the intensive care unit [1]. Knot formation is one of the rare complications with the incidence of 0.2–2.5%, which in general resulting in entrapping the catheter in the superior vena cava [2]. Surgical intervention is necessary. In recent years, due to the advances in radiology, interventional approaches are utilized to non-surgically extract the catheter [3]. We describe a case in which we succeeded removing the entrapped catheter using non-invasive procedure.

A 58-year-old male was admitted to our center with a 36-month chest pain and 12-month exacerbation. Using ultrasonic cardiogram (UCG), he was diagnosed congenital septal defect, severe aortic regurgitation and cardiac function capacity II. The patient underwent aortic valve replacement and temporary pacemaker insertion. To monitor hemodynamic measurements, a Swan-Ganz catheter was passed into the pulmonary artery through the jugular vein on the following day in the intensive care unit. After obtaining hemodynamic indexes, attempts to withdraw the catheter were unsuccessful. A chest X-ray was performed to identify an obvious knotting at the rostral end (Fig. 1), which entrapped the catheter. X-ray also revealed the annuloplasty ring and the temporary pacemaker (Fig. 2). The diameter of

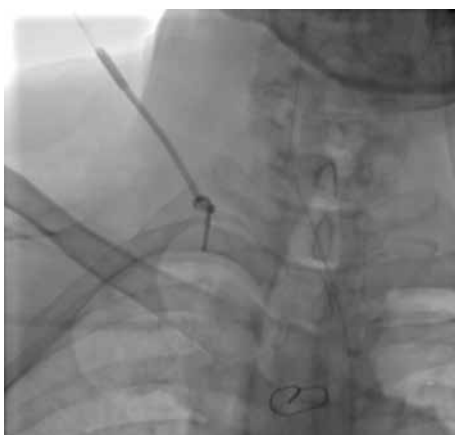


Figure 1. X-ray demonstrating the knotted Swan-Ganz catheter



Figure 2. The annuloplasty ring and the temporary pacemaker in position

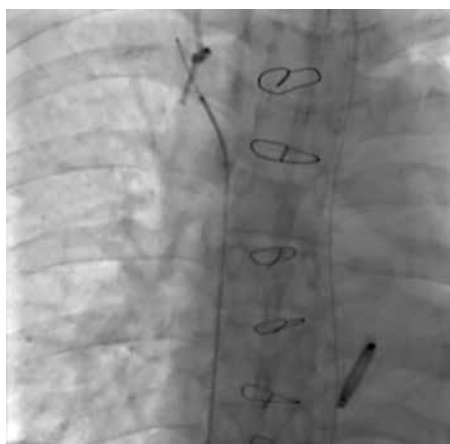


Figure 3. The angiographic catheter and the guide wire in the superior vena cava, in touch with the knotted catheter

the knot was 6 mm, and it was possible that the catheter was coiled to form a knot like structure. We designed three strategies to remove the knotted Swan-Ganz catheter: 1. Utilizing a snare to grasp the twisted end, which stabilizes the external portion, so we could turn the snare clockwise or counter clockwise to straighten the catheter and remove it from the vein. 2. A delivery sheath (congenital heart disease interventional delivery sheath) to capture the knot, cut off the catheter at other end and use the delivery sheath to retract. 3. Surgical extraction. We started with the option 1. In the hybrid operation room, under fluoroscopy the angiographic catheter (Cordis Coporation, 0.038", 100 cm, MPA1) was inserted into superior vena cava along the guide wire (Medtronic, 0.035", 145 cm) (Fig. 3). After retracting the guide wire, the snare was delivered through end-hole catheter to capture the Swan-Ganz catheter knotted end till atrium. The

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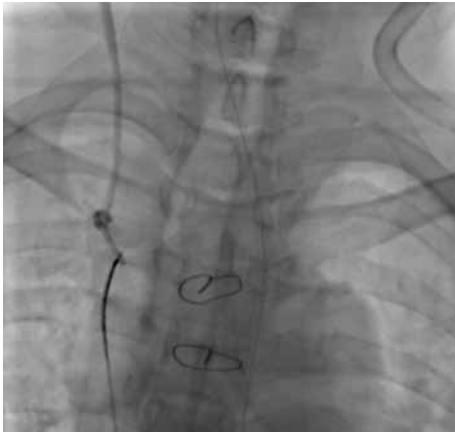


Figure 4. The snare cannot pull the catheter straight



Figure 6. The snare captures the Swan-Ganz catheter

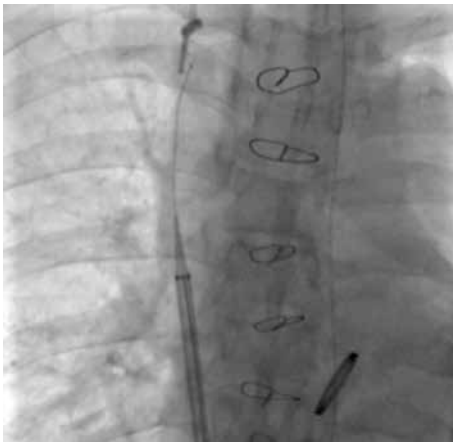


Figure 5. 14F Septal occluder into the superior vena cava

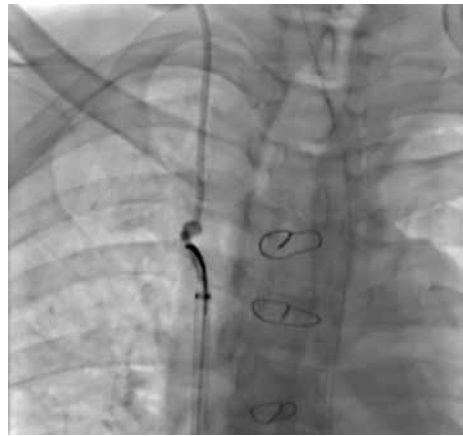


Figure 7. The knotted Swan-Ganz catheter inside the delivery sheath

catheter was unable to be straightened after turning clockwise or counter clockwise, confirming that it was knotting instead of coiling (Fig. 4). We turned to option 2 by retracting the snare to replace with another guide wire (Terumo radifocus, 0.035", 260 cm), which guided the septal occluder delivery sheath (Shanghai Shape Memory Alloy, ODS-A-14F) to reach the superior vena cava (Fig. 5). The knotted Swan-Ganz catheter was re-captured by the end-hole catheter and the snare (Fig. 6). The attempts to bring the catheter into the delivery sheath did not succeed, because of the angle between the catheter and the sheath entrance. Another recapture successfully guided the knotted catheter into the delivery sheath (Fig. 7), with 27 N forces applied (Fig. 8). The distal end was cut off from the jugular vein end (Fig. 9), and hemostasis was achieved by mechanical compression. The knotted catheter was visualized after extraction (Fig. 10).

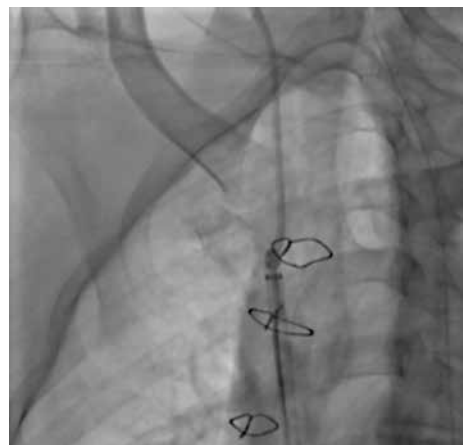


Figure 8. The knotted Swan-Ganz catheter inside the delivery sheath

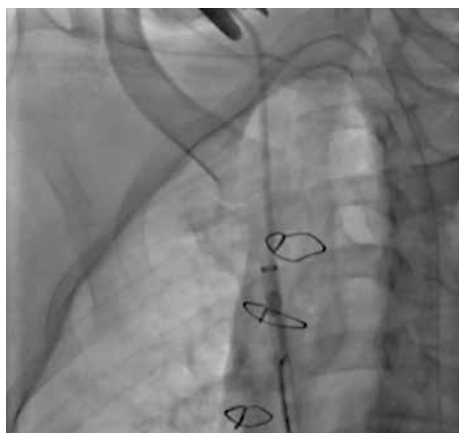


Figure 9. A cut at the jugular vein end



Figure 10. The knot of the Swan-Ganz catheter with the snare after extraction

First developed by Dr. Jeremy Swan and Dr. William Ganz in 1970, Swan-Ganz catheter is an essential diagnostic and hemodynamic monitoring method. Nowadays Swan-Ganz catheter is commonly used for critically unstable patients in intensive care units perioperatively [4, 5]. Although the causal connection between utilization of Swan-Ganz catheterization and improvement of clinical outcomes is not fully established, Swan-Ganz is one of the leading medical devices to provide hemodynamic and cardiac output evaluations [6, 7]. Well-documented complications include arrhythmias, infection, thrombophlebitis, thrombosis, cardiac perforation and pulmonary artery rupture [8]. The lattermost is the most severe complication due to catheterization, with an estimated incidence of 0.03–0.2%, mortality of 70% [9, 10]. Catheter knotting is a rare but known complication [11, 12], here we present a case involving a knotted an entrapped

Swan-Ganz catheter that was successfully removed by a snare using interventional approaches.

Previously, knotting formation of the catheter was reported in 2013 [11]. In that case, a 59-year-old patient with myocardial infarction was implanted with a Swan-Ganz catheter (110 cm 7 French 4-lumen like Baxter). The Swan-Ganz catheter reached the pulmonary artery correctly and obtained the hemodynamic parameters. However, attempts to open the knot percutaneously using radiological approach failed, the knotted catheter was extracted with surgery. In sharp contrast, we report a case that interventional approach succeeded removing the knotted catheter. In addition, we did not introduce additional complications during the procedure, thus our successful experience provides a novel alternative to deal with catheterization complications.

Knotting of the Swan-Ganz catheter formation is unknown, we hypothesize several reasons: 1. Enlarged right atrium causes catheter curls in the blood flow. 2. Catheter reaches at the distal portion of the pulmonary artery, the catheter end loops to form a knot 3. Catheter is used repetitively and the line is softened to coil. X-ray visualized the knotting formation in our case and in the previous case [11], which indicates that the knotted catheter may occur if retraction is not smooth, thus X-ray is useful to diagnose the problem. Retracting the knotted Swan-Ganz catheter from the jugular vein is extremely dangerous, because this might cause jugular vein rupture. Our experience suggests a few points to pay attention: 1. Measure the knot size, choose the proper diameter of delivery sheath (\geq knot diameter). 2. Personalize the delivery sheath, this catheter is entrapped in the superior vena cava, thus we chose the septal defect sheath with a straight portion. 3. The snare aims at the proximal end of the catheter, otherwise it is difficult to guide the catheter into the delivery sheath. 4. A neat cut at the jugular vein side is necessary to avoid vessel damage. 5. Surgical intervention is essential if the interventional approach fails, thus the procedure performed in hybrid operation room is recommended.

To sum up, not formation of the Swan-Ganz catheter is a rare complication. We reported that interventional approaches can be utilized to remove the knotted Swan-Ganz catheter in the superior vena cava. Compared to surgical removal, interventional procedures with improved resolution result in smaller lesions and better recovery.

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Isolated lower limb gangrene: a caveat of terlipressin therapy

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Sir,

Terlipressin is a synthetic analogue of the natural hormone arginine–vasopressin. It is often employed for the management of bleeding esophageal varices (BEV) and hepatorenal syndrome (HRS), both of which are catastrophic complications of advanced liver disease. Being a vasoconstrictor with preferential action on the splanchnic circulation, it aids the lowering of portal venous pressure. Terlipressin usage during BEV has been shown to decrease mortality, the failure rate of initial hemostasis, as well as the number of emergency procedures to stop uncontrolled bleeding or rebleeding [1]. In spite of its relatively safer pharmacological profile as compared to vasopressin, complications attributed to systemic vasoconstrictor properties have been occasionally reported. We encountered a case of isolated lower-limb gangrene following terlipressin therapy and wish to report it after obtaining informed written consent from the relatives.

A 67-year-old male patient with a history of alcohol-related chronic liver disease (CLD) and portal hypertension (7 years duration) was admitted to our ICU following one episode of haemetemesis, deteriorating sensorium and

reduced urine output (approx. 300 mL day⁻¹) during the previous 48 hours. The patient was an active smoker with a history of 45 pack-years. His daily intake of alcohol had been 150 g for 38 years. He had discontinued alcohol consumption 7 years ago following the initial identification of alcohol-related cirrhosis. On admission, the patient was afebrile, haemodynamically stable and icteric. After initial examination and investigations, patient was diagnosed provisionally as acute-on-chronic liver disease with decompensation and HRS. Since the concern of aspiration existed due to an ongoing oesophageal bleed and depressed sensorium secondary to hepatic encephalopathy, the patient was intubated and put on mechanical ventilation using the Continuous Positive Airway Pressure (CPAP) mode.

Subsequently, endoscopic variceal band ligation (EVL) was attempted but the procedure failed due to a persistent haemorrhage. Therefore, terlipressin therapy was considered. The patient was administered an initial bolus of terlipressin (2 mg stat) followed by 1 mg every 4 hours. Concomitantly, a 20% albumin solution infusion was commenced at a dose of 1 g kg⁻¹ day⁻¹ for the 1st day followed by 20 g day⁻¹ in view of HRS. Packed Red Blood Cells (PRBCs) and blood products were transfused based on existing haemoglobin levels, the coagulation profile and thromboelastography. After the initial conservative measures had stabilised the patient, EVL was again attempted on the 3rd day and was carried out successfully.

On the 4th day, however, a new onset of blackish discolouration of the skin of all the toes of the left foot, along